Wearable Device Analysis and How It's Data Impacts Health Monitoring

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Abstract ~ **A variety of wearable computing devices allow for accessibility of information, transference of data, and recording of data. The main question is how does one know what wearable computing device is the most accurate? Through this project, members will focus on wearable computing devices and collecting data. Our research will surround the data students receive from multiple devices and the team will use applications such, as Excel to record and illustrate our findings, deviations, and correlations between the multiple devices. Groups members, will use Apple Watch devices and iPhones to track health habits to test accuracy, for example. The group will collectively work to explore which devices or pairs of devices provide exact or precise data.**

Index terms- **Apps, Pairs, Activity App, BPM, Cluster, Guestimate, Biosensors, Algorithm**

I. INTRODUCTION

Wearable computing devices allow for a user to keep track and record of their day and their fitness simply by glancing at their watch, however, how does accuracy compare between multiple devices and varying systems? Apple Watches, for example, appear to be more polished or advanced. Yet, devices like the LG Watch Sport from Samsung heightens the competition with the addition of cellular service. The Android Wear is inferior to the Apple Watch in particular features and vice versa. Qualities such as user-friendly accessibility, accuracy, and tracking of data vary from one device to the other.

Analysis will be performed in order to see what impact wearable devices have on health. The examination of data and how that data could help or benefit health will be discussed. By tracking health through Apple, and Fitbit, the team will have the ability to display accuracy and analyze the data obtained from the varying devices from different companies. The team will additionally analyze how the data between wearable sets transfer and are managed when paired to a smartphone. This will give unique data and test the precision of varying applications and devices. Additionally, the team will be testing the transferring of data between devices which in turn illustrates how it can support the end- user. Through the research and testing, the team will accomplish the discovery of which device is more reliable and maintains appropriate support for a user.

II. BACKGROUND

Wearable computing devices can be devices worn most commonly on a person's wrists but also on other parts of their body. The reason wearables are commonly seen on a person's wrist is because it is very easy to glance over and check stats made throughout their fitness goals. The stats seen can vary, but most common ones are time, steps made, distance traveled, calories burned, and the most recent stat, the beats per minute of a heart rate.

The belief that use of wearable computing devices will increase stems from a Technology acceptance model (TAM), An integrated acceptance model was developed based on unified theory of acceptance and use of technology 2 (UTAUT2) [12], which was derived from a theory that the acceptance of technology has to do with individual's intentions to use a technology and its determining factors; factors from technology, health, and privacy perspectives. By making these wearable devices a tool that is easy to use, and very helpful to the public it will also rise the number of people using one.

One of the main challenges facing the World in recent years has been the increase in the elderly population in developed countries; over the next 20 years, the 65-and over population in the developed countries will become almost 20% of the total population [9]. This brings the need to provide health care at a more affordable cost to everyone. Adopting Wearable devices that can monitor health will create a self-service health environment to avoid any doctor visits.

A wearable device gathers data on someone's wrist by the use of a 3 axis accelerometer and/or gyroscope [5]. The data is then converted into the proper activity performed depending on the movement performed and recorded by the sensors. Other devices have technology in them for sensing altitudes, and heart rates, the data collected is all calculated to provide the user with the most accurate status of their activity performed.

III. The Apple Watch and Health

The Apple Watch allows for individuals to measure their heart rate, count their steps, and focus on a variety of health-related issues. The Apple Watch which originally launched in mid-2015 gave users a new way of tracking and understanding their health. Not only was the Apple Watch a new gadget for Apple fanatics, however, this device created a greater usefulness and resourcefulness for individuals to explore and fully comprehend their own fitness, wellbeing, and condition. The Apple Watch is an innovative device, as it allows for users to consolidate or incorporate Apple Watch applications and even third- party apps on the device. This advancement creates accessibility for users especially when it comes to fitness and health needs.

The Apple Watch not only tells time, allows users to check notifications, or call people right off of the watch, it impacts an individual's way of monitoring their health and day-to-day activities. When setting up the Apple Watch it pairs via Bluetooth connectivity with one's own iPhone. This allows for devices to be in sync and allows for the transitional ease of information from one device to another. Additionally, with the setting up of the Apple Watch, users are introduced to the Activity App which gives individuals the ability to set up their Age, Gender, Height, Weight, and whether they use a wheelchair. This allows the ability to configure one's own settings for future Activity usage. As a user

continues to configure the Activity App, users discover that the Activity application monitors how many hours a user stands, amount of calories, and minutes exercised. With this application built-in already on the device, it allows for greater accessibility for a user to see and comprehend what is affecting their health and how they can improve their own daily activity.

The availability this device creates and the ease of transitioning information from the Watch to an iPhone, gives people a faster and user-friendly approach to getting information about themselves and their health. The iPhone, previously had certain health- focused applications and the Health application built-in, yet the Apple Watch is more comprehensible and more portable in order to track an individual. The simplification of information and ease of seeing the data on two devices, make the Apple Watch more appealing to users whom are health- oriented or want to better understand their day-to-day decisions.

To test the user-friendliness and health impact of the Apple Watch, a methodology that the group used is through a team member. In order to better understand what the Apple Watch has to offer and what the true impact of the Apple Watch has on health is to test it out on an actual user and track the information and its correlation to a user's health.

The participant has a 2015 Apple Watch model and had the opportunity to use it and focus on the impact this particular wearable device has on health. The user chose the two useful features that this wearable device collects. The Activity app and the heart rate feature are chosen to examine the data and how it benefits health. Through this methodology, the student is able to analyze personal data day-to-day. This approach gives the ability a user needs to seamlessly record and examine the data that can impact one's knowledge of personal health.

Figure 1. Summary of Apple Watch Activity

IV. Methodology of Apple Watch

The Apple Watch methodology that was practiced for the first week of experiential work gave particular preliminary results. The student used the Activity app and heart rate feature from the Apple Watch. Using these applications or features give the capacity to monitor data and track how it can affect health or be beneficial information towards one's health.

Starting with the Apple Watch, there was the daily monitoring of the heart rate. The user enabled the heart rate feature on the Apple Watch consecutively and resting heart rate appeared within the range of 71 to 80 bpm on more than a few occasions throughout the week. The simplicity of accessing this information can illustrate whether an individual is sedentary or if there are any cardiovascular factors to look into. Having the accessibility to look into information that is usually difficult to keep or maintain record on, is easily on the wrist.
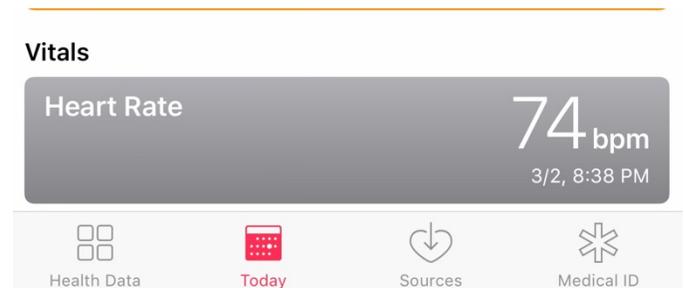

Figure 2. Heart Rate recorded by Apple Watch

To use the heart rate feature on the watch there are a few different ways to access it. It can appear right on the Apple Watch Face or in the dock which is similar to the home screen on an iPhone. After locating the feature and clicking it to start usage, it may take a few seconds to measure the heart rate. Once detected, the heart rate will be illustrated in beats per minute. Seeing this daily, gives a user a sense of their health and this can additionally be useful for understanding one's activity, one's healthy lifestyle or what is needed to be improved to adjust one's heart rate to a healthy level. A user facilitated the heart rate feature during the day, after walking and when resting or sitting down. The usual average heart rate that was recorded was 80 bpm. This information if sent to the doctor, for example, can help a doctor diagnose if there is an underlying health condition. This information will allow for the acknowledgement of heart rate and understanding any cardiovascular evidence that can be valuable to one's health.

The other feature that was used includes the Activity app. There is a multitude of information that can be discovered through the Activity application. Through Activity, the user was able to see more information that can be beneficial to their adapting health and lifestyle. The Activity app allowed the user to detect and monitor minutes of exercising and to make sure of the burning of calories that fit towards the user's personal goal. The Activity app additionally motivated the user to be less inactive and stand for more hours. This application and the details that it replays to a user is informative, as it can motivate a user to be more active and not sedentary. This can also demonstrate to a doctor the type of lifestyle a patient is undertaking and if the patient should implement more activity in their life to eliminate an inactive regime. The ability to see a progression or completion of exercising, burning calories or hours standing directly from the

Apple Watch can also independently improve the patient's lifestyle and make them more active without a trip to the doctor to motivate this decision.

The Apple Watch Activity app and heart rate feature on the Watch contains more information that works seamlessly between devices, which is easier for a patient and a doctor to discuss and analyze. With the Apple Watch and health applications available on the iPhone, the accessibility of resources allows for a consumer to monitor and keep track of multiple issues and gain updates on their progress daily or weekly. Through these devices, there are advantages or benefits with the device and that is through the consistency of the data a user will find. The variety of information that can be analyzed and recorded is consolidated onto the Watch and iPhone. Data is broken down into different categories to best understand the activity of a certain day.

Figure 3. Detailed Activity app information

This detailed breakdown of information gives users the chance to truly understand what active energy was used, the exercise minutes, fights of stairs climbed, standing hours, and of course steps. This summary of an active day is very beneficial and can keep track of how many miles even, that an individual has walked. The abundance of information that can be displayed for a user in a comprehensible manner can support a user's analysis of their health and activity. This information shows what an individual is progressing in and what they should improve on. The information summarized at the end of each day allows for a user to reflect on what they need to continue or change in their lifestyle.

V. Apple Watch and Health Literary Review

In comparison to other devices or resources such as the websites, wearable computing devices provide more frequently updated information. Wearable devices offer more for people to understand and contribute to their health experiences [7]. This also allows for a patient and a doctor to have a more detailed and observed discussion on the patient's health. Using the Apple Watch Activity app or the heart rate app can notify the patient of something that is occurring to their health and activity pattern, even when they are not at a doctor's office.

The availability of apps, as discussed in the article illustrates the detail, visuals, and accessibility that can be provided towards a user. The ability to keep up-to-date on heart rate for example, can allow a user to see if there are any abnormalities in heart rate especially when it is at resting heart rate. This information usually can be measured at a doctor's office however, with a wearable device at one's disposable can allow a patient, a wearable device user, to better understand their health and whether they may have cardiovascular risk factors. The resting heart rate averages from 60 to 80 beats per minute however, if one is a sedentary individual the heart rate can go over 100 bpm [3]. Understanding this heart rate and preliminary data, can determine a multitude of factors such as life expectancy or susceptibility to cardiovascular disease. Understanding that the specific heart rate, especially resting heart rate averaged as 80 beats per minute, shows the ease and simplicity of determining whether there are any signs of cardiovascular disease risks. The ability to see this pivotal information right off of the wearable device is beneficial and can help a patient and doctor understand whether a patient has a high risk or low risk of a cardiovascular disease. The heart rate can be recorded daily and can be sent to a doctor, thus identifying any detrimental patterns that may occur to the cardiovascular.

There are many applications being used and they focus on monitoring exercise [7]. Many applications are also used for medication interactions. These apps and the accessibility of them on wearable devices, can help the discussion between practitioners and patients. Apps that are available on the Apple Watch such as the heart rate feature and the Activity app provide "continuous monitoring of bodily functions and behaviors" [7]. The ability to continue with one's day and not be preoccupied with a device, makes wearable devices such as the Apple Watch a great resource to collect data on an individual's health. Wearable devices allow for real-time updates and information that is at the ready. These devices make information that used to solely be accessible to the medical workers in the field, available for users and for individuals that are not a part of the medical field.

Apps and wearable devices give users of the devices the ability to gain visuals and knowledge about medical and health issues as well as any abnormalities. The Activity app on the Apple Watch, for example, will demonstrate whether a patient needs to become more active or if they should adjust their caloric goals. These apps and features within the wearable devices promote vigilance as a user and make users more hands- on about their health. These apps and wearable devices promote positive health and fitness.

Even though there are many benefits and there is a sense of usefulness with Apple Watches or wearable devices, there can be some flaws or issues with the apps or devices. In order to better understand this, more testing and recording of data is needed to discover the accuracies and benefit of wearable devices.

Wearable devices such as the Apple Watch can promote a healthier lifestyle and provoke inquiry and curiosity about an individual's health. From monitoring heart rate, to counting steps, and watching the amount of time one may exercise, can support an individual's lifestyle and enhance their health. These notifications that are always on hand may assist a user with determining if they are healthily living or not.

VI. The Fitbit and Health

When a patient is diagnosed and recommended a treatment that involves physical activity outside the supervision of a medical professional, it is that person's responsibility to stick to the proposed regiment for getting better. It is sometimes difficult to meet the guidelines set for physical activity [5]. The person may forget, or not feel as motivated, this can put the patient at risk of not healing properly. For a patient who needs to undergo physical activity in order to get better a wearable device can assist them with getting the job done. Packed with many features it will help someone set their goals, plan the course of action, monitor themselves, and be able to receive precise feedback because of the data recorded by the wearable [5]. The feedback received from the data is important because it is a cluster of data that was recorded by the device, and not a guestimate done by the patient undergoing the process. For an example we have the wearable device Fitbit Charge HR. It can help the user keep track of basic features such as steps, calories, distance, and if that isn't enough it can track exercise features such as Heart rate using its biosensors, Cardio vascular level, remind the user to move, exercise, drink water, or just stand up from extensive house of sitting in one location. Setting up the Fitbit a user would first download the Fitbit app to their smartphone. Compatible smartphones with the Fitbit app are Android and IOS devices. The Fitbit device will pair with the smartphone via Bluetooth when the app is opened. The user would go through various settings to customize the Fitbit so it may generate data more efficiently. It will ask the user what hand they will wear the Fitbit on, Right or left. Supplemental settings can be configured such as height, weight, gender, etc. By setting up the Fitbit with an individual's personal information the algorithms used to calculate calorie counts, heart-rate, and steps will become more accurate in judging the correct calculations.

All this data recorded for the user in real-time can be synced to a smart phone Apple, or Android, or found on the Fitbit website under the users personal account. Having this data brought to a personal doctor for review will allow them to have a wider understanding of the effort, time, and status of exercise done in order to give more accurate feedback on the progress of the user's health.

Wearable devices are always improving both in the; algorithm it uses to measure and track its movements, from hand movements to actual steps and then using those calculations to further calculate heart-rates, and calories burned; to its user interface and the simplicity it must provide for any person to use the device and understand what is being read [4]. For a patient the levels of sustained use of the wearable is dependent on the disease, patient behavior, and measurement needed.

VII. Fitbit Methodology

With the Fitbit, data sets were recorded such as the steps, floors climbed, distance, duration, calories burned, and heart rate. These were all key data points that were recorded throughout a series of days.

Figure 4. Summary of exercise phase

The data was broken down by the hour, showing each hour how many steps were took, the number of floors climbed and at what time it happened, the calories that were burned and the time that the calorie count spiked or decreased. These basic features can help a patient keep track of the time frame of activities

that they underwent and the effort that their body gave at a particular time. A Patient who is monitoring a heart condition would be find this data informative to their health status. If an abnormal or slight change of normality is brought to concern about one's health, going back and viewing this data can see if there was a change in activity effort to cause such concerns, or the change was initiated by any other cause.

The Fitbit App on a smart phone, and on the Fitbit website will show a dashboard with data graphed throughout the day in the various categories available. Steps being a common item viewed by most people will be shown in a bar graph format depicting the amount of steps made in a series of 15 minutes. Along with a 7-day average, comparison to yesterday's steps, and a total lifetime steps made since the Fitbit had been set up. Similar with Floors climbed, and Calories burned a bar graph will depict progress made over a series of minutes, depending on a walking pattern. Spikes in activity levels are organized under "Activity History" this is a place where if during a certain time frame the bodies activity level was higher than the usual resting levels, it will give the option to analyze the data within that time frame and compare the progression thoroughly, comparing it side by side to heart-rate levels, steps, calories burned, and time spent "active".

Figure 5. Hourly Steps recorded by Fitbit
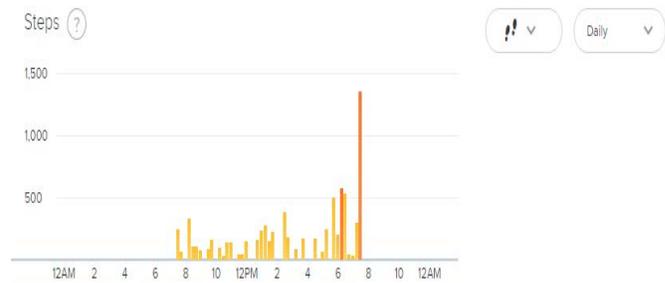
The Fitbit Charge HR also has a wonderful feature where is can track daily heart-rate levels. For patients suffering from high blood pressure [1], monitoring the heart-rate can help avoid and/or manage foreseen signs of increase blood pressure. The Fitbit monitors the person's heart rate in real time, it can be checked at any time quick and easy. The heartrate data is recorded on a linear graph scale. More information can be viewed about the heart rate under an activities panel where the data is managed and shows different heart rate levels, amount of time spent at peak heart-rate, amount of time the heart rate was at levels of fat burning, or cardio, and the average Beats-per-minute (BPM) throughout the day.

Figure 6. Daily Fitbit Statistic Registry

Date	Steps	Floors	Miles	Calories	Average BPM	Peak BPM
4/10/2017	13,835	17	6.88	3,490	71	152
4/9/2017	1,913	4	0.92	2,291	72	122
4/8/2017	6,390	8	3.08	2,688	72	133
4/7/2017	12,688	20	6.24	2,663	72	125
3/18/2017	832	0	0.4	2,078	70	98
3/17/2017	3,738	4	1.8	2,527	70	100
3/8/2017	8,491	17	4.09	2,902	70	100
3/7/2017	8,773	17	4.29	3,021	69	112
3/6/2017	14,590	24	7.11	3,828	69	132
2/12/2017	1,266	2	0.61	2,167	66	104
2/11/2017	3,236	3	1.56	2,355	67	114

Figure 7. Per Fitbit; Side by Side correlation of Statistics

VIII. Fitbit and Health Literary Review

To understand how the features of a wearable device can help a real medical need, research had to be done in order to understand correlations between the functions that a wearable measures and the medical conditions it can help monitor. A clear correlation is made between movement and a medical condition [2]. Osteoporosis is a condition where the bones become weak from loss of tissue, movement would cause pain from the bones rubbing up on each other. The study made the correlation that physical activity actually reduces the pain caused by the medical condition under the correct guidelines. This article helped us correlate a medical conditions diagnosis to a wearable allowing the treatment to be more active. The use of the Wearable would help the person monitor and push them to reach the physical activity goal provided for the medical condition to lessen and be more manageable.

There is a theory that the reason wearables aren't so widely accepted and even put to use for a long time is because of its unreliability to deliver the most accurate data needed. [1] A user of a wearable according to the article loses motivation to stay dedicated to monitoring one's health if there is a bit of misinformed data. The data collected by the wearable is not perfectly accurate. Each wearable collects its data through its own methods, sometimes the data is manipulated based on outside conditions in accordance to the users setting. The heart-rate monitor on a Fitbit will not always be accurate, its sensing ability matters on the conditions of the skin, at times it could become moist thus influencing a skew in the data. Activity monitoring has the potential to engage the patients in a personalized care, by offering more data it can lead to more efficient forms of treatment and patient-doctor relation.

There is a connection between heart rate and cardiovascular risks [10]. Cardiovascular risks stemmed from high blood pressure and caused by many causes but begin with hypertensions and from a high heart rate. Many wearables in today's time can come equipped with a simple heart rate monitor that can alarm the person when the heart rate reaches high levels. This warning can announce incoming cardiovascular risks such as for example; heart attacks. To be ready for such an attack can help in catching it and even preventing one from coming to pass. This is a health risk that transcended age groups as it is a possibility for almost any person at any age. The use of a wearable is not age restricted nor should it be.

A wearable is meant to be an everyday accessory for the everyday man and woman. Its purposes go beyond managing known, and current health issues one might have but also manage and prevent future health concerns that could arise. In a corporate structure health insurance is possible given out as part of the Company's benefits [6]. More new with Corporations if ones health is in jeopardy insurance deliverables can be quite high. Keeping in shape, and staying healthy at all times would secure an individual to stay financially in a comfortable location while under the employment of a company.

Not all wearables are devices that are meant to be worn on the wrist like a Fitbit or Apple Watch. There are wearable Technologies that can be placed on the body, those are considered to be more specialized in sensing more accurate data levels for a cause. A wearable headband that is worn on the head and through the use of light it is able to measure brain synchronization when humans interact [4].

This device discovered that when communicating with another individual the wearable measured the oxygenation and deoxygenation of blood cells in the test subject's brains. The brain is still considered a mystery and through this device scientists and doctors can learn more about the brain and how it truly operates. The main benefit of this wearable is that its predecessor was a machine that required the test subject to lay motionless in a quiet room. This new technology allows the test subject to move freely and interact with more people and events which will generate more brain cognition for further study.

IX. Data Analysis and Visualization

Various data has been recorded so far including steps, heart-rate, calories burned, distance reached and minutes of exercise. However, the quantity of data recorded are not enough for a comprehensive analysis and visualization. It is difficult to compare the performances of the Apple Watch and Fitbit devices as well. Due to the time and device limit, it is hard to get adequate data samples that are from same person and recorded at the same time. The Datasets have been obtained from a study from the Internet [11]. The following graph shows the table snippet of the data.

Figure 8. Daily Correlation of statistics

date	activities_minutesLightlyActive	activities_minutesSedentary	activities_minutesVeryActive	activities_steps	activities_tracker_calories
2015/7/31	10	205	0	195	1867
2015/8/1	269	672	37	12866	3245
2015/8/2	168	691	35	5023	2867
2015/8/3	143	1161	66	10112	2982
2015/8/4	150	836	23	5725	2734
2015/8/5	267	640	16	9155	3012
2015/8/6	111	907	0	2731	2219
2015/8/7	34	1378	0	867	1893
2015/8/8	280	704	0	6525	2640
2015/8/9	237	670	14	9002	2836
2015/8/10	72	1055	0	2160	2029
2015/8/11	0	1440	0	0	1758
2015/8/12	0	1440	0	0	1758
2015/8/13	0	1440	0	0	1758
2015/8/14	241	1173	0	6378	2723
2015/8/15	206	627	50	11000	3342
2015/8/16	202	690	0	4839	2568
2015/8/17	90	841	0	2280	2116
2015/8/18	204	847	0	5419	2581

Through the use of Python the raw Data was transformed into good shape. All the statistics were displayed in a linear graph followed by their Standard Deviation (SD).
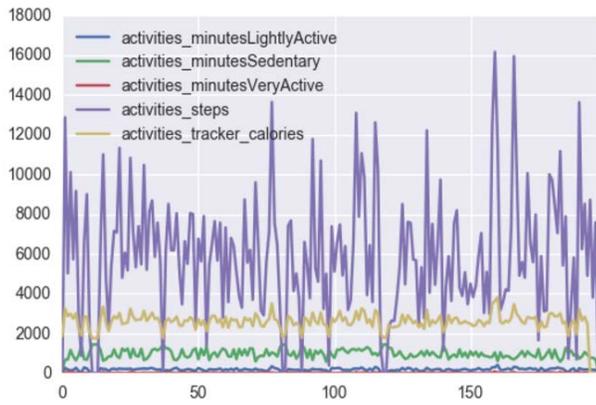
Figure 9. All the Data Recorded

A Conclusion can be brought about from these plots directly and intuitively, that step samples (purple line) have a wide range of distinction nevertheless calories tracked (yellow line) are not sensitively influenced by steps and have a base line of 2000. An assumption can be made that this is a human natural calorie consumption despite physical activities.

Figure 10 and Figure 12 show the steps taken and calories burned by each day with proportion. Figure 5 shows the relation between calories-burned and steps-taken each day.

Figure 10. Standard Deviations of each Statistical Properties
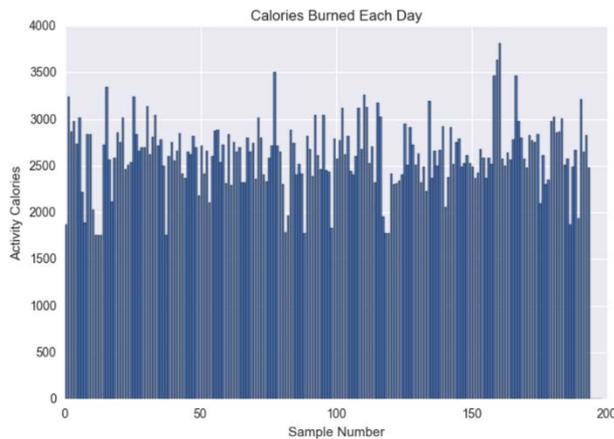
Figure 10. Calories Burned Each Day
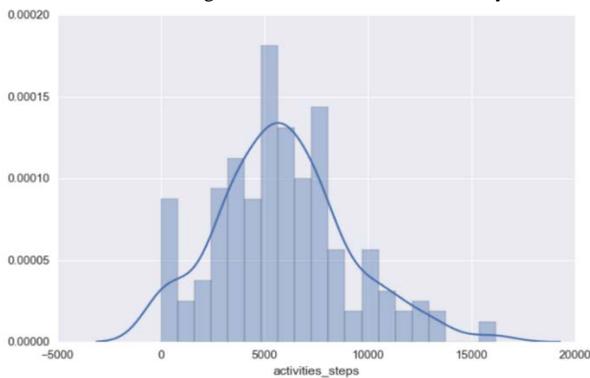
Figure 11. Relation between Calories-Burned and Steps-Taken Each Day

As per the relation-plot above, calorie consumption has an approximately linear relationship with steps taken, that is:

$$Calorie = 2000 + 0.1 \times Step$$

Note that this is an assumption, which has no solid evidence and needs to dig further in detail. It is only a simple estimation of the algorithms adopted by the wearable devices.

Figure 12 and 13 show the difference between the data obtained by Apple Watch and data obtained by Fitbit.

Figure 12. Daily Step Difference between Fitbit and Apple Watch

The steps differences in Figure 12 are generally within 800 from the chosen 40 data samples. The calorie differences in Figure 13 are basically within 100.

Figure 13. Daily Calories Difference between Apple Watch and Fitbit

Thus from the plots, Apple Watch and Fitbit do have a distinction of accuracy and sensitivity for tracking and counting steps, as well as calorie consumption calculation. Knowing that these differences would not have a significant impact on the overall performances, they do not yet come to an extent of being ignored. According to some user investigations, a few users complained about the detection accuracy of Apple Watch. This may be one of the reasons that we got these differences. Note that the subtype of the devices might be variant and source of data is to be validated, we could not draw a solid conclusion that which device is more accurate or more sensitive. However, looking forward to future endeavor, we could approach further when requisition of time and data amount to be met.

IX. Getting Data from Fitbit Web Interface

In the previous sections daily health data were recorded in a summary format on phone apps. We had to keep track of it and record it into a xsl or csv file. It's sort of inefficient and the data are not elaborate enough. Surely we could access registered Fitbit/Apple account to find the records, still the data are somehow al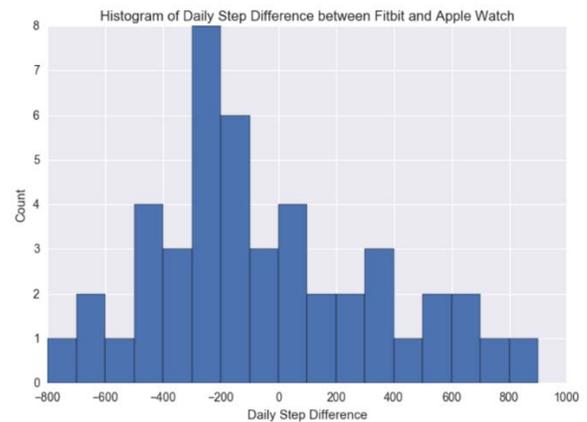ready processed before sending to users. Thinking of retrieving raw data directly from Fitbit Web Api, through the use of an application [13] it allowed for a user to visit, authenticate and access Fitbit official dataset. The results were displayed in a website, which is deployed on Amazon Web Service. The source code can be easily viewed in GitHub. Figure 14 shows the website and test user profile average data summary. Click on the Login button, we can get to the Fitbit login page and access the data.

Figure 14. Project Website for Fitbit Web Api

One challenge of this sub-project is the authentication. Fitbit doesn't allow third party organization to authenticate users. Fitbit requires identifications and protocols to validate in Oauth2.0 standard. Figure 15 shows the registered app profile in Fitbit with identifications such as client ID and Secret. With these IDs we can set up the communication and gain the statistics.

Figure 15. Fitbit Application Registration Page for Developers

Figure 16 shows the access page that users grant permission to view the profile. The checkbox indicates what type of information can be seen, which can be managed in our codes

Figure 16. Fitbit Permission Page for User Data

The website shows the overview of the profile. We could get detail dataset straightforward by implementing programming methods in Fitbit interfaces. This application can bring great benefits to users and managing their data. Through future advancements the application could hopefully help the further study on Fitbit health devices.

VIII. CONCLUSION

According to the above analysis, it is observed that wearable fitness devices, such as the Fitbit and Apple watch, were comparatively accurate for tracking steps and heart rate. However, there would be a slight deviation in the data records from the corresponding step counts and heart rates. Therefore, it is not the accuracy of a tracker that should be taken into consideration, but, also, the associated mobile application, customization options, flexibility with different mobile systems, appearance, accessibility, and synchronization to the different mobile devices

that totally affect the utilization of the tracker that provides perfect interpretation of the recorded data through the mobile application.

Thus, the usage of fitness trackers, has mostly increased to study and examine physical activities, like the number of calories burned on step count or monitoring heart rates, sleep monitoring, distance, etc. For such day-to-day actions, it is necessary for the data to be precise, easily calculated, and qualitative. This is because the increased utilization and accurate data and features provided by such wearable devices may help us to improve quality of life and help increase the integration of mobile technology into day-to-day activities.

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